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MAXIMIZING USEFULNESS OF NATIVE FRUIT GERMPLASM

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Maximizing Usefulness Of Native Fruit Germplasm

Final Report, 2005

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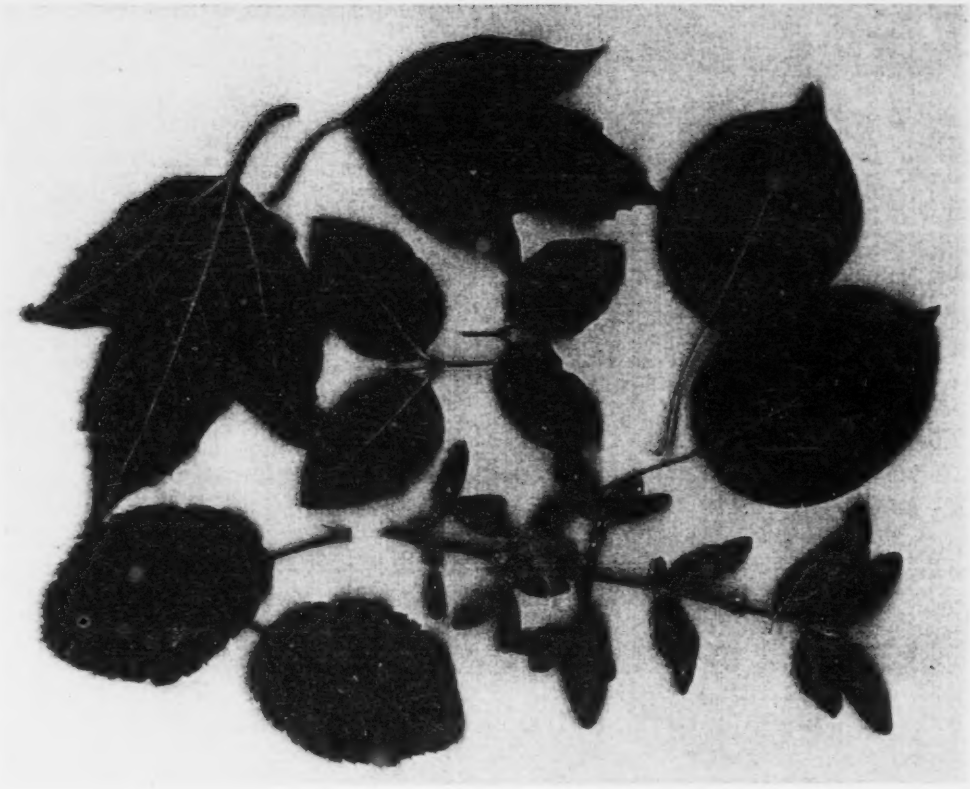

Prepared by Bob Bors and Jennifer Hall

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ABSTRACT

The objective of this study was to identify and preserve valuable germplasm from the plots formerly maintained by Native Fruit Development Program for stakeholders, future research and breeding at the U of S. Propagation was done for some chokecherries but many cultivars had already been propagated. These were distributed to interested stakeholders. Seeds were collected from wild collections and stored at the U of S and will be sent to genebanks. A field day was held to allow stakeholders to observe the native fruit collections during harvest season. Stakeholders gave their opinions and discussed priorities for germplasm preservation.

Personnel from the Fruit Breeding Program made observations of promising selections and useful germplasm was identified and preserved for posterity. The Chokecherry collection will be maintained while studies are being done on their oil content and will likely be used in breeding.

EXECUTIVE SUMMARY

The purpose of the grant was to identify and preserve valuable germplasm from the plots formerly maintained by the Native Fruit Development Program (NFDP). Activities included:

1. Weeding, pruning and spraying occurred on the plots, maintaining the collection in excellent condition while we evaluated the usefulness of the plantings.
2. Propagation was done for some chokecherries but many cultivars had already been propagated. These were distributed to interested stakeholders.
3. Seeds were collected from wild collections and stored at the U of S and will be sent to genebanks.
4. A field day was held to allow stakeholders to observe the native fruit collections during harvest season. Stakeholder gave their opinions and discussed priorities for germplasm preservation.
5. Personnel from the Fruit Breeding Program made observations of promising selections and useful germplasm was identified and preserved for posterity.

The saskatoon collection from the NFDP is probably the world's best collection of Saskatoons and will continue to be preserved by the U of S Fruit Program. However, most of the production research plots are in the process of being removed. Also to be removed is an older plot of seedlings from which selections have already been propagated.

The Chokecherry collection will be maintained while studies are being done on their oil content and will likely be used in breeding.

Most of the other collections, particularly the demonstration plots, will be downsized. As they have educational value for students and may be useful for scientist requiring various species to sample, small numbers of selections will be maintained.

PROJECT PERSONNEL

Bob Bors, Assistant Professor in the Plant Sciences Department coordinated the activities of the program. Jennifer Hall was the chief technician for the project. She was assisted by Nathan Dzialo and Rick Sawatzky. Both Jennifer and Nathan spent approximately half their time on the Native fruit collection and half on another grant.

PROJECT GOALS

Identify and preserve valuable germplasm for stakeholders and for future research and breeding at the U of S. Hypothesis: The Fruit Breeding Program and stakeholders have different criterion for selection and may want to preserve only part of the native fruit germplasm. Maintaining much of this germplasm for an additional 2 seasons will provide a window of opportunity to get maximum use of this collection.

Plan:
0. Maintain collection in a reasonable state.
1. Create a catalog of existing germplasm, both cultivars and wild accessions.
2. Include descriptions of material excerpted from the various NFDP Reports on file
3. Circulate this catalog to stakeholders and get feedback / orders for plant material
4. Propagate and distribute plant material to stakeholders.

Introduction

The Native Fruit Collection occupied approximately 10 acres at the University of Saskatchewan (see Figure 1). This grant allowed us to maintain these plots for one season while we decided what to keep and what to downsize. This grant allowed Stakeholders to be consulted and germplasm to be preserved during the process of downsizing.

Inventory of Native Fruit Germplasm

A list of cultivars was compiled from records left by Richard St. Pierre and it was verified that these cultivars were still alive in the field (Table 1). That list, except for blueberries, was sent to interested stakeholders (Table 2). The inventory of blueberries was not sent to stakeholders because the plants were in very poor condition and they are not well adapted to soil pH over 7. Also, none of the listed blueberry cultivars were rare.

In addition to the cultivars in table 1 there were sizable collections of seedlings of saskatoons and chokecherries. Plot plans have names that are; People's names, locations, or accession numbers. In the case of people's name or locations, there was no accompanying documentation describing their origins nor any recorded observations, although the planting year was often noted. Less

than 5% of the seedling saskatoons and chokecherries had accession numbers. The origins of this later group were documented in accession books by Rick Sawatzky who had recorded them in the years prior to the Native Fruit Program. A list of miscellaneous accessions is listed in Table 2.

Figure 1. Native Fruit Development Program Field map.

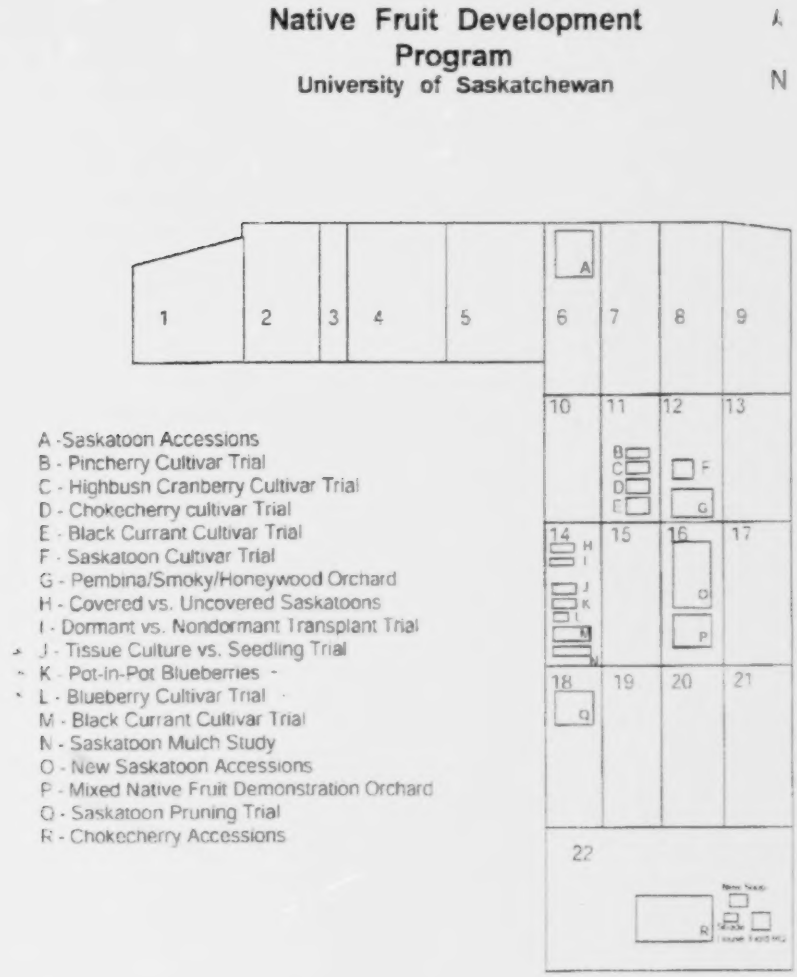

Table 1. **Inventory of cultivars in Native Fruit Collection.**

Saskatoon - *Amelanchier alnifolia*

Bluff	Honeywood	Northline	Pasture	Quaker	Success
Buffalo	Martin	Par 90 TRS	Pearson II	Regent	Thiessen
Forestburg	Nelson	Parkhill	Pembina	Smoky	

Black Currant - *Ribes nigrum*

5-24-9	5-23-42	25-23-23	4-24-29
Ben Alder	Boskoop Giant	Magnus	Topsy
Ben Lomond	Consort	McGinnis Black	Wellington
Ben Nevis	Coronet	Noir de Bourgogne	Willoughby
Ben Sarek	Crusader	Titania	

Missouri Currant *Ribes odoratum*

Black Giant

Chokecherry - *Prunus virginiana*

Boughen Yellow	Garrington	Lee	Mission Red
Copper Shubert	Goertz	Maxi	Robert

Highbush Cranberry - *Viburnum opulus var. americanum*

Cv 8	Cv 9				
Alaska	Andrews	Garry Pink	Manito	Phillips	Wentworth

Pincherry - *Prunus pensylvanica*

Jumping Pound	Lee #4	Mary Liss

Blueberries – *Vaccinium sp.*

Chippewa	Chignecto	Cumberland	Northsky
Northblue	Patriot	Polaris	St. Cloud

Table 2. Inventory of seedlings and miscellaneous plants from the Native Fruit Program.

Crop	Approximate # of Plants	Comments
Saskatoons	5000	2 plots, one over 15 years old, another less than 3 years old. Highly variable seedlings.
Chokecherries	2000	From various sources, 50% selected from PFRA. Highly variable seedlings.
Roses	45	Appear to be Rose Hip varieties. Perhaps 15 varieties but names not recorded. They have uniform appearance.
Seabuckthorn	45	Unknown origin

In addition to the cultivar trails and seedling collections, there were eight plots related to production research that involved only saskatoons. On Figure 1, these were areas: G, H, I, N, and Q. Area G was perhaps 15 years old while Areas H, I, N, and Q were 1 or 2 years old. The varieties in these plots were popular cultivars such as Pembina, Smokey, Honeywood, and Theissen. Thus they did not contain any unique germplasm.

Descriptions of Material

When this grant was proposed it was suggested that a description of the varieties compiled from Native Fruit Development Program (NFDP) reports and records would be worthwhile to include in a catalog of the accessions. However we were left with no such records.

The Former website of the NFDP website had an extensive descriptions of cultivars. By the time this project began, that website had been dismantled with the understanding that the files of that website would reappear as part of a website hosted by SAFRR and the new Knowledge Centre. It was felt to be more important to distribute the list of cultivars ASAP then to include descriptions. As it turns out most propagators and PFRA stakeholders were already familiar with the varieties and did not need descriptions. General description of the state of the various collections were made so that their value could be assessed.

Table 3. **Stakeholders consulted regarding Native Fruit Germplasm**

Organizations	Contacts
Government	
Ag Canada, PFRA Indian Head	Bill Schroeder
Ag Canada, Clonal Genebank, Harrow, ON	Margie Luffman
Ag Canada, Outlook, SK	Jazeem Wahab
Ag Canada, PBI, SK, SK	Martin Reaney
SAFRR	Clarence Peters
University of Saskatchewan	Doug Waterer, Karen Tanino, Tom Ward
Growers	
Saskatchewan Fruit Growers Association	Board of Directors Growers at their meetings
Alberta Fruit Growers Association	Board of Directors
Domestic Fruit Program	Mailing List of 300 growers Workshop Attendees
Native Fruit Field Day	Attending growers
Riverbend Plantation	Grace and Lee Whittington
Prairie Berries	Sandy Purdy
Propagators	
Prairie Plant Systems	Ellen Batty
D n' A Gardens	Arden Dellidais
Saskatoon Farm	Paul Hammer

Feedback from Stakeholders after receiving the catalog of accessions

Table 1 was sent to individuals listed in Table 2. Except for the e-mail list of 300 growers, Dr. Bors spoke to each person and group to get their feedback. It was during the discussions that Dr. Bors described the collections of seedlings and answered questions. Approximately 25 growers from the email list also spoke to Dr. Bors. The following sections summarize the stakeholders' views regarding the usefulness of the various collections.

Saskatoons

-The saskatoon collection was regarded as the world's most extensive collection of cultivars and seedlings.
-It was noted that neither PFRA Indian Head nor Ag. Canada's Clonal Genebank had much of this collection. Although plants have been set aside to ship to the Ag. Canada's Clonal Genebank in spring, there was concern that the saskatoons

might not do well there and that the University should maintain the collection regardless.
-Propagators and processors weren't interested in new varieties as a general rule and not interested in older varieties and so did not want to take any of them on. One exception is that a propagator wants to propagate PAR 90, which is an experimental selection developed by the NFDP. That propagator felt it had many superior qualities at their location.
- Conversely, growers were very interested in the new and old varieties. Most felt that there were many areas that could be improved with saskatoon varieties and they urged us to do some breeding in this area particularly for disease resistance and uniformity of ripening. They felt that the cultivar collection was both interesting and useful.
-The old seedling patch (Area A, Figure 1) had already been screened for disease resistance with the better plants cloned and planted in Area O. It was suggested by many that this patch had served its purpose and could be eliminated.
- The newer seedling patch (Area O) was viewed as very exciting as this had arisen from seeds sent from around the prairie from growers and from collecting trips. It was noted by Dr. Bors and visiting growers that the berries in this field seem exceptionally flavourful compared to the cultivar trials.
- Many of the newer plantings of Saskatoons were for orchard production practices for which there is no funding and for which there are no complete records detailing these experiments. It was felt by those consulted at the University that these plots should be removed.

Chokecherries

-The seedling chokecherry patch is probably the 2nd largest chokecherry collection in Canada with PFRA, Indian Head having the largest collection. While the PFRA collection is more diverse, the University's collection has been subject to inoculations of Black Knot Disease, and is thus valuable for screening this disease.
-This collection predates the NDFP. As an older planting, this collection is valuable for assessing desirable attributes such as dwarf size, productivity, etc.
-As much of this planting was derived from superior seedlings in the wild and at PFRA, there is the possibility that some of this material may be superior to standard varieties.
- Martin Reaney, in cooperation with Dr. Bors has been analyzing this collection for oil content and has already identified some potentially useful accessions. This Analysis will not be complete until some time in April 2005. It is likely that the selections with desirable oils will need to be verified late summer of 2005.
- Jill Thomson (U of S, Plant Pathologist) and Clarence Peters (SAFRR) scrutinized the entire collection when the fruit was ripe, and tagged trees that seemed desirable. Mainly they considered yield, tree structure, flavour and disease resistance. IN addition to their choices, Rick Sawatzky tagged a few more plants that may be valuable for breeding, and in particular some of the very dwarf trees were identified.

Black Currents

-The black current collection is dated, consisting mainly of older varieties which growers and propagators are not interested in.
-Knowledgeable growers are mainly planting the 'Ben' series, which are unique because they possess high resistance to powdery mildew, the number one disease of black currents.
-It was noted that Alberta researchers were testing 6 Ben Series cultivars and that the U of S had only two 'Ben" series in their collection.
-The Ag Canada Clonal genebank expressed an interest in obtaining cuttings from our collection in the spring.

Miscellaneous Native Fruit

-The remainder of the native fruit collection are those species with the least economic opportunities for Saskatchewan. Very few Saskatchewan growers are cultivating these species.
-As these collections are neither particularly extensive nor unique, they have little value in terms of germplasm.
-They have educational value and are used in courses and are an interesting component to tours. Besides the Fruit Course, they may be of value to botany courses, and graduate students.
- They have been used to supply seeds to local nurseries.
- They may be useful as a source of seed for reforestation projects or in game preserves. Small collections of many varieties would facilitate cross pollination which would result in very diverse progeny. Such diverse progeny could be particularly useful in generating woodland habitats.
- Such collections may be useful for researchers who are attempting to locate sources of particular compounds, such as oils or nutraceuticals. For example, in recent years many researchers have scoured the plant world in search of plant high in melatonin. It would be an asset to have such a collection close to the University and Innovation Place.

Germplasm Preservation

Table 4 summarizes the actions taken regarding the Native Fruit Collection.
It was considered that the most valuable parts of the collection were some of the Saskatoons and chokecherries.
The saskatoon collection of cultivars and younger seedlings will be kept, but the older collection which has already been evaluated, will be removed in 2005. It is noted that seeds were gathered from that older planting and stored for future use.

The Chokecherry Patch will be maintained until Martin Reaney completes his evaluation. The best selections can be identified and propagated and used in breeding. It is likely that patch will remain for at least 2 more years.

Several mature stands of Black Currents and Saskatoons were kept 'on hold' pending whether or not funding can be obtained to study mechanical harvesting. These are likely to be downsized to allow equipment for mechanical harvesting.

Some plots are of value for educational purposes and possibly for future research and screening. It is likely that these demonstration plots will be downsized but examples of each type of crop will be maintained.

Table 4. **Summary of Action taken for Native Fruit Collections.**

Native Fruit Collection, 2004			
Action	Block	Plants	Comments
Remove	6	Sk Seedlings,	Old overgrown patch, best plants were propagated, Seeds of families were gathered for genebank
Remove	11	Demo orchard	Most rows only 1 variety
Keep	12	Sk Cultivars	
On Hold	12	Sks, long rows	Keep until we hear about ADF grants, may be useful for any of the 3 grants being proposed. Very likely that downsizing would occur even if awarded grants.
Downsize	14	Black Current trial	Remove middle two rows so remaining 4 rows can be mechanically harvested.
Keep	14	2 rows of Sk	Keep for use in mechanical harvesting study
Consolidate* then remove	16	Demo orchard: Replicated collection of cultivars	Most of these varieties are not commercially viable and experiments with them would be meaningless. Some varieties could be saved for demonstration. A few varieties are worthwhile. Note: the cultivars of black currents in this area are inferior to the younger planting in block 14
Remove	16	Blueberries	Woodchips need to be scooped out of that area
Keep	16	Young SK seedlings	Genetically diverse collection, not yet evaluated. Will keep for several years.
Keep for 2 years	22	Chokecherry collection	Martin Reaney is evaluating these lines for superior oil content. Jill Thomson and Clarence Peters have evaluated for disease resistance and dwarf characters. Will begin propagating superior plants after Reaney study is complete.
Distribute	Shadehouse	Perhaps 300 plants in pots	Sets of rare Sk's set to 12 growers plus Ag Canada Genebank Other plants, not rare give or sold to growers at events

Appendix 1: Letters sent to various stakeholders.

Fruit Program
University of Saskatchewan

April 19, 2004

To Whom it May Concern,

Due to cutbacks, the Native Fruit Development Program at the University of Saskatchewan has been terminated. The Native Fruit Development Program carried out research involving cultivar evaluation, management practices, pruning, food quality analysis, tissue culture propagation, breeding, accession evaluation, pesticide evaluation, and Integrated Pest Management, chiefly for saskatoons, but also including chokecherry, pincherry, highbush cranberry and black currant.

Dr. Bob Bors has received a small amount of funding to help preserve the genetic diversity of these native fruit varieties, but this funding will last only through 2004. It is therefore quite important to us to identify organizations interested in preserving these varieties. We may be able to supply seed and/or cuttings of named varieties or bulk collections of open pollinated seeds. If we find groups that wish to partner with us, it may be possible to keep some of this collection going for use as propagation stock plants. If we cannot find interested partners we may have to remove some or all of these collections.

Please find enclosed a list of the species and cultivars of native fruits that we have in our field plots. Additionally, about a dozen types of saskatoon accessions (seed gathered from the wild) have been selected for disease resistance and propagated through tissue culture and a small number of 3 year old plants are available. Although fruit quality has not been determined, we feel these accessions would be valuable for a future breeding program. Please indicate if you are interested in these.

We are also compiling a list of the suppliers (retail dealers as well as non-profit organizations) of these native fruits and would like to know which species and cultivars your organization has that we have. Please contact:

Jennifer Hall
adriana34@hotmail.com
306-978-8316

IF you cannot contact Jennifer, Write to Bob Bors at: bob.bors@usask.ca

Thank you for your support and interest.

Sincerely,

Update letter sent to Saskatchewan Fruit Growers Association directors and various stakeholders to aid in determining future research possibilities with the existing collections.

Native Fruit Resources at the University of Saskatchewan, as of summer 2004

Note: there will be a complete write up on these resources during the winter months as part of an ADF grant to evaluate/downsize/save this material.

We are very interested in obtaining feedback from SFGA regarding the Native fruit orchards at the University of Saskatchewan and other satellite sites and how they could be used to further research needs of growers. As ADF applications are due November 15, we need to have a clear message from SFGA regarding what research they need and are willing to support. If there seems to be no interest or funding for this material we will be removing much of it. Typically, after grain is harvested, there are many hands available from the crews in Plant Sciences to remove old orchards.

We have received some input from the mostly new growers that attended our "Native Fruit Tour and Discussion Group" on Aug 5th. We are also keenly interested in the views of the Board of directors of SFGA, as this would represent a more experienced group. Please feel free to express your opinions and we recognize that it is likely impractical to save all the orchards. We really are interested in what you feel is most important for yourselves and other growers.

We currently have funding in place for the "Domestic Fruits" and fruit breeding through 2005. That grant does have a value-added component for Saskatoons in it but that grant assumed Saskatoon fruit was coming from the Native Fruit development program. That grant does not have the capacity to maintain the sizable collections left by the NFDP.

U of S Orchards

Saskatoons

1. Mature stand with replicated rows of Pembina, Smoky and Honeywood, suitable for regeneration, pruning, mechanical harvesting studies.
2. Cultivar trial with 3 replicates of 3-bush plantings of 17 cultivars, providing material for evaluation for taste, processing, yield, maturity, etc.
3. Young (3 –4 yr. old) accession block with plantings of new material sent to us by individuals throughout western Canada. This is probably the most genetically diverse collection of Saskatoons in the world. It has interesting possibilities but it needs to grow for a while to fully see its potential.
4. Very mature accession orchard, at least 15 years old. Closely planted and of mixed genetic material. Used for selecting plants with superior characteristics, and fungicide and insecticide trials. This orchard is the first

of the list for removal unless an alternative use is found. Seeds of this orchard have been processed for the gene bank.

Other Native Crops

1. Choke cherries: a very large diverse seedling collection
2. Black Currents & highbush cranberry: 20+ cultivars each, but most are not considered desirable by industry
3. Pin cherries, seabuckthorn, buffaloberry: only a few varieties of these. These are mainly useful as demonstration for students

Other sites

1. Dale Porter's – Saskatoon Culivar trial, same set up as at UofS, located just outside of Saskatoon.
2. CSIDC - mature bushes in replicated trial of 3(?) saskatoon standard cultivars. Could be used for replicated trials. Also has demonstration rows of other crops. Has several rows of Garrington chokecherry, seemingly without enough pollinators nearby.

Co-operators

A number of growers have provided bushes used in replicated trials, in particular for pruning, mulching, insecticide, fungicide evaluation.

Equipment

Spray applicators, suitable for small or large scale applications.
Pruning, harvesting, and grading equipment.
Irrigation.
Post-harvest fruit cooling.
Fruit Quality analysis

Personnel

Dr. Bob Bors – plant breeder, Domestic Fruit Program. Experienced in cultivation of tree fruits, breeding of fruit.
Dr. K. Tanino – plant physiologist. Proposing a study to evaluate quality of locally grown produce c.f. imported produce (fruit and vegetable)
Dr. J. Thomson – plant pathologist. Research associate with Native Fruit Program since 1997. Currently completing IPM study for control of saskatoon diseases.
Dr. D. Waterer – vegetable and spice specialist. Development and maintenance of viable alternative crops for the province. Experienced with minor use registration.
J. Hill – technician with NFDP for at least 6 years. Experienced in all aspects of saskatoon management, tissue culture.

Suggested problems needing research studies

Note: these are not ranked in importance

1. Regeneration - Many orchards throughout the province are approaching maturity but the best ways to rejuvenate are unclear. How should this be done? Pruning, removal and replanting, cutting back to ground level, trimming like hedges, burning off ? Could growth regulators be useful? Are certain cultivars easier to regenerate? Economics and yield changes involved, timing till next fruiting, impact on disease control. Long term study as need at least 5 years to collect yield data.

2. Mechanical harvesting – How much is mechanical harvesting damaging bushes? What is the impact of mechanical harvesting on disease? Observational study using commercial orchards plus trial?

3. Cultivar selection - Extending season, suitability for freezing, processing, flavour differences and public preferences. Changes in fruit quality and yield as each cultivars ages? Uniformity of ripening?
4. Grading standards: How do the major cultivars compare when the new grading standards are applied? Are the fruits of some cultivars more variable in size and more of a problem to grade?
5. Do value-added difficulties need to be addressed by researchers?

6. Pesticides: Many growers seem very concerned about pest control and it is often pests that have influenced yield.

    a. Post-harvest treatments for control of insects and diseases.
    b. Fungicide with reduced pre-harvest interval to prevent fruit infection with leaf and berry spot just prior to harvest.
    c. Evaluation of products for organic orchards.

7. Plant growth regulators: perhaps could be used for size control of bushes, improve fruit set, improve dormancy, increase uniformity of ripening or allow earlier or later harvesting. There are many growth regulators available to apple growers that potentially could be used on Saskatoons.

Most of the above ideas were written with the Saskatoon in mind but are applicable to other fruit crops. It may be more beneficial to perform similar research simultaneously on several crops. Increasingly, growers are interested in diversifying their fruit crops to spread out their risks and to extent their harvest season. As a group that represents fruit growers it is important that we attempt to benefit a wider range of growers. Please include suggestions for the other crops particularly where needs are similar to needs for the major crops.

Appendix 2: Letters regarding germplasm value from Ag Canada.

From: "Bill Schroeder" <schroederb@agr.gc.ca>
To: <bob.bors@usask.ca>
Subject: Native Fruit Germplasm Collections
Date: November 5, 2003 4:14 PM

Hi Bob:

Further to our telephone conversation regarding native fruit germplasm collections at the UofS, please consider the value of the collections to science and the horticulture industry before any decisions are made to have them removed. The collections are valuable sources of genetic material and in some cases the only source available. This is especially true for the Amelanchier collection which is the most complete in North America. I urge you to consider retention of at least a representative portion of this collection.

regards,

Bill Schroeder
Head, Investigations Section / Chef, Section des enquêtes
Shelterbelt Centre / Centre des brise-vent
Environment Team / Equipe d'environnement
Agriculture and Agri-Food Canada/Agriculture et Agroalimentaire Canada
Telephone/Téléphone: 306-695-5126 / 306-695-7424
Facsimile/Télécopieur: 306-695-2568
Box 940
Indian Head, Saskatchewan
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schroederb@agr.gc.ca

Website: http://www.agr.gc.ca/pfra/shelterbelt.htm

From: "Margie Luffman" <luffmanm@agr.gc.ca>
To: <bob.bors@usask.ca>
Subject: Native Germplasm
Date: October 31, 2003 12:55 PM

Hello Bob. I have heard about the recent developments in the native fruit germplasm program at the University of Saskatchewan and I was concerned. I am so pleased to have an opportunity to help ensure that some of the affected germplasm will not be lost. The Clonal Genebank will be glad to cooperate in every way possible and we will be glad to accept any germplasm that falls within our mandate, as this collection certainly does. It will be maintained here in field plantings and/or protected culture in perpetuity. Of course it would be available for distribution at no charge to requesters.

I look forward to cooperating in this process.

Margie

Margie Luffman
Curator/Conservatrice
Canadian Clonal Genebank/Banque canadienne de Clones
Environment Team/Equipe d'environnement
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